



1st Landing Site Workshop, May 14-16, 2014

The Importance of Mars 2020 and Gusev Crater

Alex Longo

The Montessori School of Raleigh Middle School

NOTE ADDED BY JPL WEBMASTER: This content has not been approved or adopted by, NASA, JPL, or the California Institute of Technology. This document is being made available for information purposes only, and any views and opinions expressed herein do not necessarily state or reflect those of NASA, JPL, or the California Institute of Technology.

Only One Chance

- The Mars 2020 rover costs an estimates \$1.5 billion
- Only one rover will ever be produced
- Mars 2020 should be sent to a site with previous ground truth for highest probability of mission success
- Gusev Crater's geologic goldmine, along with the public relations benefits associated with returning to MER Spirit, make it an ideal landing site for Mars 2020

Why Return to Gusev?

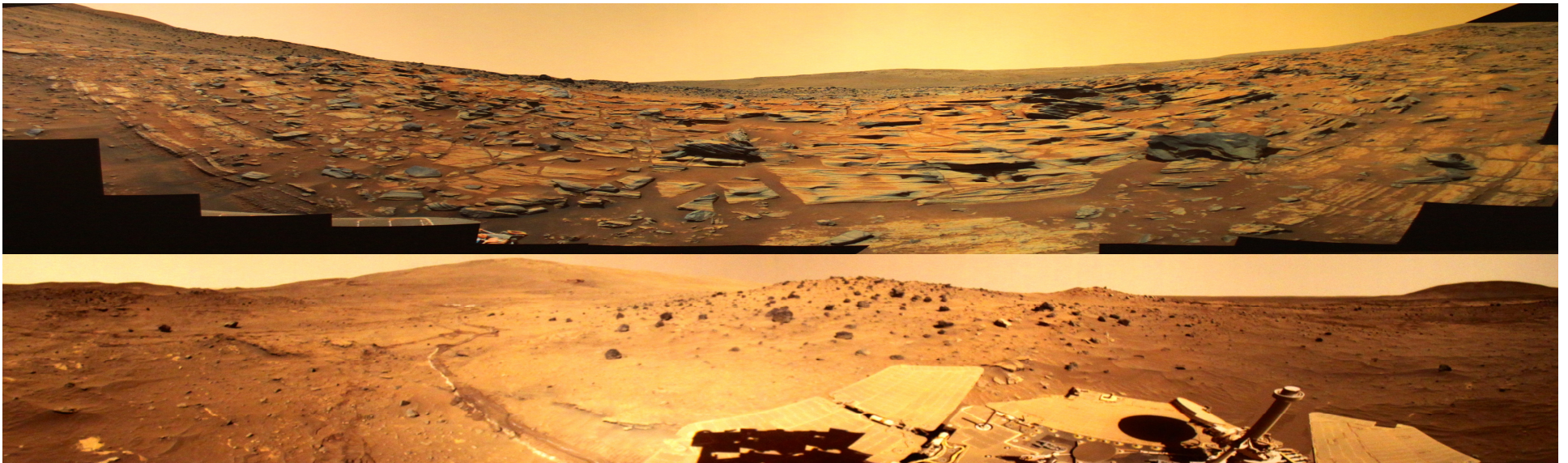
- Being a land-on site, combined with pre-explored ROIs, make for maximum productivity in the primary mission
- Low amount of hazards in ellipse
- Returning to Gusev allows for a “second field session” with improved equipment over Spirit hardware
- Returning to Gusev would be inspiring to the next generation of explorers

The Importance of Ground Truth

- Operations of Mars 2020 would be more efficient at a site with previous ground truth
- Surface hazards would be kept at a minimum due to lessons learned from Spirit
- Science targets have been validated from the surface, allowing for more caching and more efficient science campaigns during the primary mission

What We Learned From Spirit

- Carbonate outcrops indicative of a Noachian lake
- Noachian Phyllosilicates in South East?
- Silica deposits indicate hydrothermal activity
- Aqueous processes ~2 million years ago
- Hesperian volcanic basalts common on plains



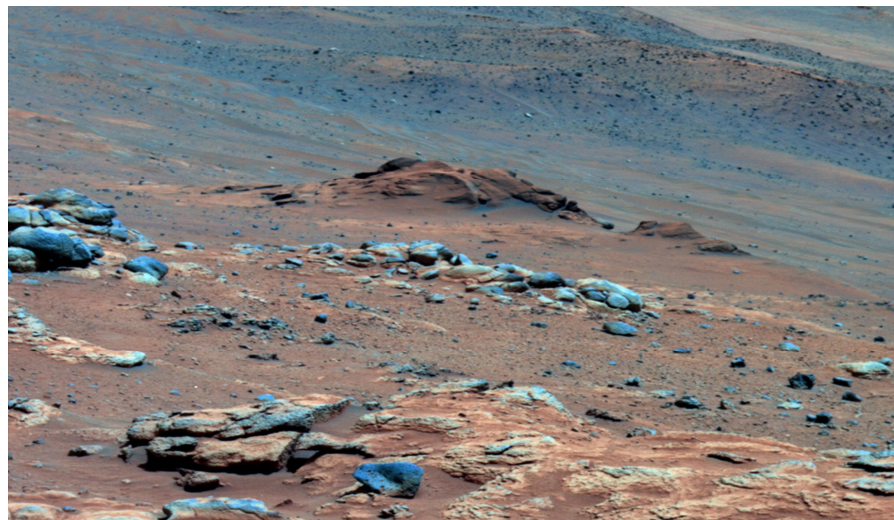
The Importance of Mars 2020 and Gusev Crater

Gusev Crater and the Mars 2020 Science Goals



Exploring Habitability and Astrobiology

- Mars 2020's instrument suite is more sophisticated than Spirit's
- Diverse geologic record (three aqueous environments)
- On Earth, environments teeming with microbes



Searching for Signs of Past Life



- Diverse habitable environments = multiple potential biosignatures
- Subsurface silica protected from radiation and degradation of organics
- Young, water-altered rocks too recent for organics to degrade

Sample Return

- Gusev Crater has significant benefits for sample return
- Gusev geology allows for diverse samples
- Experience and knowledge from Spirit will allow for quicker Mars 2020 traverses and science campaigns
- This allows other missions in Mars Sample Return campaign to launch earlier, getting samples to researchers as early as possible

The Importance of Mars 2020 and Gusev Crater

E2E-iSAG and Gusev Crater

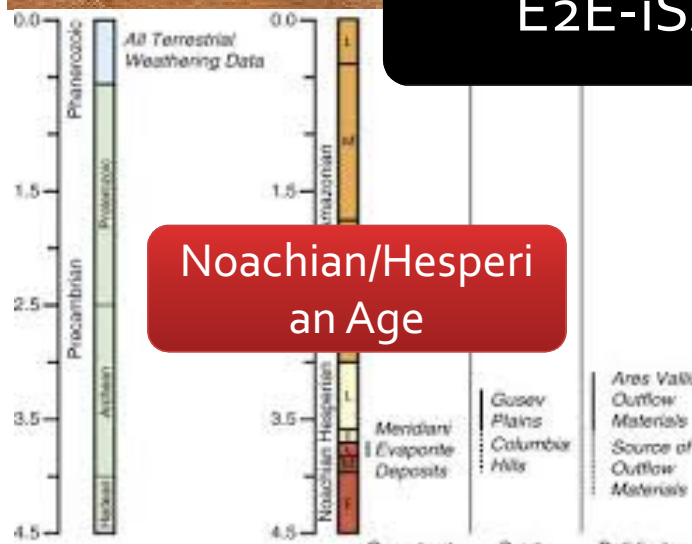
Hydrothermal
Deposits

Water Altered
Outcrops

E2E-iSAG Goals

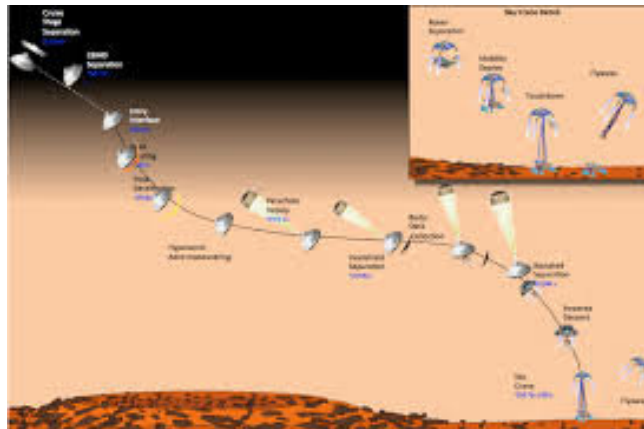
Noachian/Hesperian
Age

Igneous Rocks and
Volcanic Features



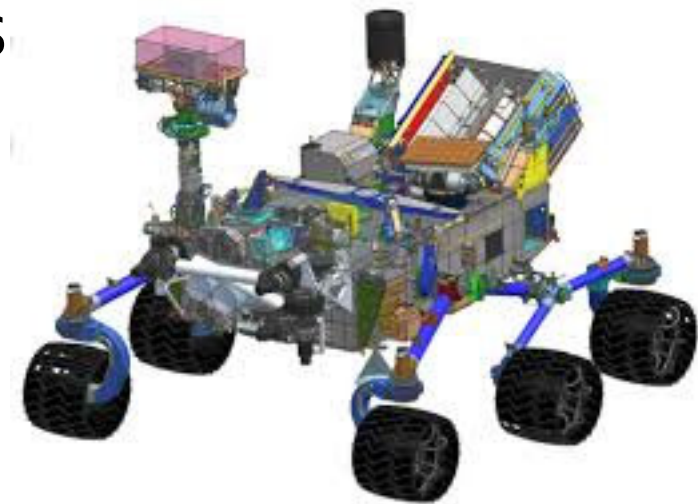
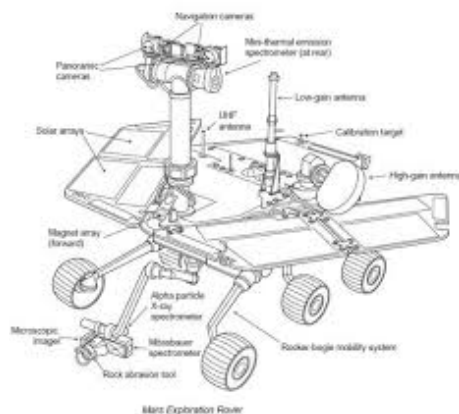
Gusev EDL Benefits

- Landing already performed (Spirit)
- Very few rover threatening rocks and boulders
- Relief in Columbia Hills better than in portions of MSL final four candidate sites (M2020 SDT)
- Elevation within requirements for Mars 2020
- No EDL enhancements needed



What Spirit Was Not Able to Complete

- Spirit left a lot of work uncompleted
- It never explored a volcanic explosion crater called Goddard, or the speculated phyllosilicates
- The Mars 2020 rover's instruments will be more capable than Spirit's



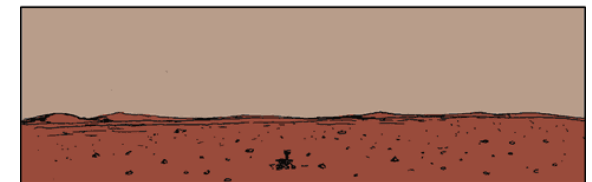
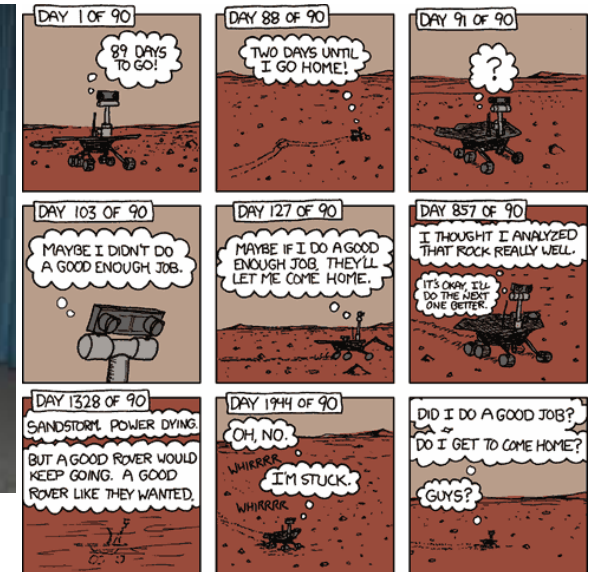
Summary of Science

- A Mars 2020 mission in Gusev Crater would successfully accomplish the rover's science goals
- Ground truth provides extra mission assurance and shortens the wait time for returning samples



The Importance of Mars 2020 and Gusev Crater

Spirit Rover in Popular Culture



Dear Spirit:

We love you! Have a great nap, and I can't wait to hear what you learn in the spring.

Send As:

Send



Spirit Rover

14.61 S, 175.53 E Troy

Gusev Crater, Mars 10404



Public Relations Benefits of Returning to Gusev

- Hundreds participated in “Free Spirit” campaign to save rover
- Thousands of electronic “postcards” have been sent to Spirit, continuing to the present
- Since Spirit will have been defunct for 10 years in 2020, a new rover, traverse path, and instrument suite will make Gusev feel like a new landing site

Public Relations Benefits of Returning to Gusev

- The public would be interested in returning to Gusev and acquiring images of Spirit's final resting place
- Education material could be quickly and accurately designed from previous data
- Mars 2020 could place a memorial plaque near Spirit, if weight and space constraints allow

What Spirit Meant to the Public

- Spirit took on a personality of its own
- The rover enjoyed scientific and engineering highs and lows during the mission
- Spirit turned its difficulties into successes
- Misfortunes became wonderful opportunities to learn
- Spirit persevered right up until its “death”
- To the scientific community and the public, Spirit was more than just a rover

The Importance of Mars 2020 and Gusev Crater
Husband Hill Summit



My Experience With Gusev Crater

- Spirit launched in 2003, when I was only three years old
- I started following Spirit in 2005, and passionately supported it all the way until the end of the mission
- Thousands of other members of the public have had similar stories from following Spirit
- Spirit inspired my love of science and exploration

Education Benefits of Returning to Gusev

- Spirit landed in 2004, which means children who followed it will play important roles with the Mars 2020 mission
- To inspire the next generation of explorers, build upon the ground truth from Spirit for higher probability of success
- Higher social media/video from “conversations” between Spirit & Mars 2020



The Importance of Mars 2020 and Gusev Crater

Education Benefits of Returning to Gusev

- One experiment on Mars 2020 could be competitively designed by students from the known Spirit data
- “Messages to Spirit” CD with notes to Spirit from the public could be sent to Mars



Conclusion

- Landing in Gusev would create maximum public support for NASA
- Mars 2020 will add on to Spirit's discoveries
- Photos of Spirit's final resting place could be obtained for future human exploration
- Mars 2020 could answer the question "Are we alone in the universe?"
- If the Mars 2020 mission lands in Gusev Crater, it will allow NASA to take maximum advantage of the unique opportunity offered by this mission

Earth from Mars

Earth as seen from Mars



Inspiration


I am the quest for knowledge.

I am seeking answers to questions left unanswered.

I am perseverance.

I am inspiring future generations of explorers.

I am Mars 2020.



Many of these images are from the "10 years on Mars photo gallery at the National Air and Space Museum. All images of Mars' surface are credit of the NASA Mars Exploration Rover mission.